SEQUENCE LISTING

<110> Sorrentino, Brian
Bunting, Kevin

<120> EXPANSION OF HEMATOPOIETIC STEM CELLS TRANSDUCED WITH MDR-1 METHODS OF USE THEREOF

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<151> 1998-05-28

<150> PCT/US99/11825
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Ala Thr Thr Ile Ala Glu Asn Ile Arg Tyr Gly Arg Glu Asn Val Thr
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Met Asp Glu Ile Glu Lys Ala Val Lys Glu Ala Asn Ala Tyr Asp Phe
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Ile Met Lys Leu Pro His Lys Phe Asp Thr Leu Val Gly Glu Arg Gly
515 520 525

Ala Gln Leu Ser Gly Gly Gln Lys Gln Arg Ile Ala Ile Ala Arg Ala
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Leu Val Arg Asn Pro Lys Ile Leu Leu Leu Asp Glu Ala Thr Ser Ala
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Leu Asp Thr Glu Ser Glu Ala Val Val Gln Val Ala Leu Asp Lys Ala
565 570 575

Arg Lys Gly Arg Thr Thr Ile Val Ile Ala His Arg Leu Ser Thr Val
580 585 590

Arg Asn Ala Asp Val Ile Ala Gly Phe Asp Asp Gly Val Ile Val Glu
595 600 605

Lys Gly Asn His Asp Glu Leu Met Lys Glu Lys Gly Ile Tyr Phe Lys
610 615 620

Leu Val Thr Met Gln Thr Ala Gly Asn Glu Val Glu Leu Glu Asn Ala
625 630 635 640

Ala Asp Glu Ser Lys Ser Glu Ile Asp Ala Leu Glu Met Ser Ser Asn
645 650 655

Asp Ser Arg Ser Ser Leu Ile Arg Lys Arg Ser Thr Arg Arg Ser Val
660 665 670

Arg Gly Ser Gln Ala Gln Asp Arg Lys Leu Ser Thr Lys Glu Ala Leu
675 680 685

Asp Glu Ser Ile Pro Pro Val Ser Phe Trp Arg Ile Met Lys Leu Asn
690 695 700

Leu Thr Glu Trp Pro Tyr Phe Val Val Gly Val Phe Cys Ala Ile Ile
705 710 715 720

Asn Gly Gly Leu Gln Pro Ala Phe Ala Ile Ile Phe Ser Lys Ile Ile
725 730 735

Gly Val Phe Thr Arg Ile Asp Asp Pro Glu Thr Lys Arg Gln Asn Ser
740 745 750

Asn Leu Phe Ser Leu Leu Phe Leu Ala Leu Gly Ile Ile Ser Phe Ile
755 760 765

Thr Phe Phe Leu Gln Gly Phe Thr Phe Gly Lys Ala Gly Glu Ile Leu
770 775 780

Thr Lys Arg Leu Arg Tyr Met Val Phe Arg Ser Met Leu Arg Gln Asp
785 790 795 800

Val Ser Trp Phe Asp Asp Pro Lys Asn Thr Thr Gly Ala Leu Thr Thr
805 810 815

Arg Leu Ala Asn Asp Ala Ala Gln Val Lys Gly Ala Ile Gly Ser Arg
820 825 830

Leu Ala Val Ile Thr Gln Asn Ile Ala Asn Leu Gly Thr Gly Ile Ile
835 840 845

Ile Ser Phe Ile Tyr Gly Trp Gln Leu Thr Leu Leu Leu Leu Ala Ile
850 855 860

Val Pro Ile Ile Ala Ile Ala Gly Val Val Glu Met Lys Met Leu Ser
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Gly Gln Ala Leu Lys Asp Lys Lys Glu Leu Glu Gly Ala Gly Lys Ile
885 890 895

Ala Thr Glu Ala Ile Glu Asn Phe Arg Thr Val Val Ser Leu Thr Gln
900 905 910

Glu Gln Lys Phe Glu His Met Tyr Ala Gln Ser Leu Gln Val Pro Tyr
915 920 925

Arg Asn Ser Leu Arg Lys Ala His Ile Phe Gly Ile Thr Phe Ser Phe
930 935 940

Thr Gln Ala Met Met Tyr Phe Ser Tyr Ala Gly Cys Phe Arg Phe Gly
945 950 955 960

Ala Tyr Leu Val Ala His Lys Leu Met Ser Phe Glu Asp Val Leu Leu
965 970 975

Val Phe Ser Ala Val Val Phe Gly Ala Met Ala Val Gly Gln Val Ser
980 985 990

Ser Phe Ala Pro Asp Tyr Ala Lys Ala Lys Ile Ser Ala Ala His Ile
995 1000 1005

Ile Met Ile Ile Glu Lys Thr Pro Leu Ile Asp Ser Tyr Ser Thr Glu
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Gly Leu Met Pro Asn Thr Leu Glu Gly Asn Val Thr Phe Gly Glu Val
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Val Phe Asn Tyr Pro Thr Arg Pro Asp Ile Pro Val Leu Gln Gly Leu
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Ser Leu Glu Val Lys Lys Gly Gln Thr Leu Ala Leu Val Gly Ser Ser
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Gly Cys Gly Lys Ser Thr Val Val Gln Leu Leu Glu Arg Phe Tyr Asp
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Pro Leu Ala Gly Lys Val Leu Leu Asp Gly Lys Glu Ile Lys Arg Leu
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Asn Val Gln Trp Leu Arg Ala His Leu Gly Ile Val Ser Gln Glu Pro
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Ile Leu Phe Asp Cys Ser Ile Ala Glu Asn Ile Ala Tyr Gly Asp Asn
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Ser Arg Val Val Ser Gln Glu Glu Ile Val Arg Ala Ala Lys Glu Ala
1140 1145 1150

Asn Ile His Ala Phe Ile Glu Ser Leu Pro Asn Lys Tyr Ser Thr Lys
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Val Gly Asp Lys Gly Thr Gln Leu Ser Gly Gly Gln Lys Gln Arg Ile
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Ala Ile Ala Arg Ala Leu Val Arg Gln Pro His Ile Leu Leu Leu Asp
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Glu Ala Thr Ser Ala Leu Asp Thr Glu Ser Glu Lys Val Val Gln Glu
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Arg Leu Ser Thr Ile Gln Asn Ala Asp Leu Ile Val Val Phe Gln Asn
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Val Gly Val Phe Gly Met Phe Arg Tyr Ala Asp Trp Leu Asp Lys Leu
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Cys Met Ile Leu Gly Thr Leu Ala Ala Ile Ile His Gly Thr Leu Leu
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Pro Leu Leu Met Leu Val Phe Gly Asn Met Thr Asp Ser Phe Thr Lys
65                  70                  75                  80

Ala Glu Ala Ser Ile Leu Pro Ser Ile Thr Asn Gln Ser Gly Pro Asn
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Ser Thr Leu Ile Ile Ser Asn Ser Ser Leu Glu Glu Glu Met Ala Ile
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Tyr Ala Tyr Tyr Tyr Thr Gly Ile Gly Ala Gly Val Leu Ile Val Ala
        115                 120                 125

Tyr Ile Gln Val Ser Leu Trp Cys Leu Ala Ala Gly Arg Gln Ile His
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Lys Ile Arg Gln Lys Phe Phe His Ala Ile Met Asn Gln Glu Ile Gly
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Trp Phe Asp Val His Asp Val Gly Glu Leu Asn Thr Arg Leu Thr Asp
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Asp Val Ser Lys Ile Asn Asp Gly Ile Gly Asp Lys Ile Gly Met Phe
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Phe Gln Ser Ile Thr Thr Phe Leu Ala Gly Phe Ile Ile Gly Phe Ile
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Ser Gly Trp Lys Leu Thr Leu Val Ile Leu Ala Val Ser Pro Leu Ile
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Gly Leu Ser Ser Ala Leu Trp Ala Lys Val Leu Thr Ser Phe Thr Asn
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Lys Glu Leu Gln Ala Tyr Ala Lys Ala Gly Ala Val Ala Glu Glu Val
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Leu Glu Arg Tyr Asn Lys Asn Leu Glu Glu Ala Lys Asn Val Gly Ile
275 280 285

Lys Lys Ala Ile Thr Ala Ser Ile Ser Ile Gly Ile Ala Tyr Leu Leu
290 295 300

Val Tyr Ala Ser Tyr Ala Leu Ala Phe Trp Tyr Gly Thr Ser Leu Val
305 310 315 320

Leu Ser Asn Glu Tyr Ser Ile Gly Glu Val Leu Thr Val Phe Phe Ser
325 330 335

Ile Leu Leu Gly Thr Phe Ser Ile Gly His Leu Ala Pro Asn Ile Glu
340 345 350

Ala Phe Ala Asn Ala Arg Gly Ala Ala Phe Glu Ile Phe Lys Ile Ile
355 360 365

Asp Asn Glu Pro Ser Ile Asp Ser Phe Ser Thr Lys Gly Tyr Lys Pro
370 375 380

Asp Ser Ile Met Gly Asn Leu Glu Phe Lys Asn Val His Phe Asn Tyr
385 390 395 400

Pro Ser Arg Ser Glu Val Gln Ile Leu Lys Gly Leu Asn Leu Lys Val
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Lys Ser Gly Gln Thr Val Ala Leu Val Gly Asn Ser Gly Cys Gly Lys
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Ser Thr Thr Val Gln Leu Met Gln Arg Leu Tyr Asp Pro Leu Glu Gly
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Val Val Ser Ile Asp Gly Gln Asp Ile Arg Thr Ile Asn Val Arg Tyr
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Leu Arg Glu Ile Ile Gly Val Val Ser Gln Glu Pro Val Leu Phe Ala

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Thr Thr Ile Ala Glu Asn Ile Arg Tyr Gly Arg Glu Asp Val Thr Met
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Asp Glu Ile Glu Lys Ala Val Lys Glu Ala Asn Ala Tyr Asp Phe Ile
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Met Lys Leu Pro His Gln Phe Asp Thr Leu Val Gly Glu Arg Gly Ala
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Val Arg Asn Pro Lys Ile Leu Leu Leu Asp Glu Ala Thr Ser Ala Leu
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Asp Thr Glu Ser Glu Ala Val Val Gln Ala Ala Leu Asp Lys Ala Arg
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Glu Gly Arg Thr Thr Ile Val Ile Ala His Arg Leu Ser Thr Val Arg
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Asn Ala Asp Val Ile Ala Gly Phe Asp Gly Gly Val Ile Val Glu Gln
595 600 605

Gly Asn His Asp Glu Leu Met Arg Glu Lys Gly Ile Tyr Phe Lys Leu
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Val Met Thr Gln Thr Arg Gly Asn Glu Ile Glu Pro Gly Asn Asn Ala
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Tyr Gly Ser Gln Ser Asp Thr Asp Ala Ser Glu Leu Thr Ser Glu Glu
645 650 655

Ser Lys Ser Pro Leu Ile Arg Arg Ser Ile Tyr Arg Ser Val His Arg
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Lys Gln Asp Gln Glu Arg Arg Leu Ser Met Lys Glu Ala Val Asp Glu
675 680 685

Asp Val Pro Leu Val Ser Phe Trp Arg Ile Leu Asn Leu Asn Leu Ser
690 695 700

Glu Trp Pro Tyr Leu Leu Val Gly Val Leu Cys Ala Val Ile Asn Gly
705 710 715 720

Cys Ile Gln Pro Val Phe Ala Ile Val Phe Ser Arg Ile Val Gly Val

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Phe Ser Arg Asp Asp Asp His Glu Thr Lys Arg Gln Asn Cys Asn Leu
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Phe Ser Leu Phe Phe Leu Val Met Gly Leu Ile Ser Phe Val Thr Tyr
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Phe Phe Gln Gly Phe Thr Phe Gly Lys Ala Gly Glu Ile Leu Thr Lys
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Arg Val Arg Tyr Met Val Phe Lys Ser Met Leu Arg Gln Asp Ile Ser
785 790 795 800

Trp Phe Asp Asp His Lys Asn Ser Thr Gly Ser Leu Thr Thr Arg Leu
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Ala Ser Asp Ala Ser Ser Val Lys Gly Ala Met Gly Ala Arg Leu Ala
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Val Val Thr Gln Asn Val Ala Asn Leu Gly Thr Gly Val Ile Leu Ser
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Leu Val Tyr Gly Trp Gln Leu Thr Leu Leu Leu Val Val Ile Ile Pro
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Leu Ile Val Leu Gly Gly Ile Ile Glu Met Lys Leu Leu Ser Gly Gln
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Ala Leu Lys Asp Lys Lys Gln Leu Glu Ile Ser Gly Lys Ile Ala Thr
885 890 895

Glu Ala Ile Glu Asn Phe Arg Thr Ile Val Ser Leu Thr Arg Glu Gln
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Lys Phe Glu Thr Met Tyr Ala Gln Ser Leu Gln Val Pro Tyr Arg Asn
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Ala Met Lys Lys Ala His Val Phe Gly Ile Thr Phe Ser Phe Thr Gln
930 935 940

Ala Met Met Tyr Phe Ser Tyr Ala Ala Cys Phe Arg Phe Gly Ala Tyr
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Leu Val Ala Gln Gln Leu Met Thr Phe Glu Asn Val Met Leu Val Phe
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Ser Ala Val Val Phe Gly Ala Met Ala Ala Gly Asn Thr Ser Ser Phe

980 985 990

Ala Pro Asp Tyr Ala Lys Ala Lys Val Ser Ala Ser His Ile Ile Arg
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Ile Ile Glu Lys Thr Pro Glu Ile Asp Ser Tyr Ser Thr Glu Gly Leu
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Lys Pro Thr Leu Leu Glu Gly Asn Val Lys Phe Asn Gly Val Gln Phe
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Gln Trp Leu Arg Ala His Leu Gly Ile Val Ser Gln Glu Pro Ile Leu
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His Gln Phe Ile Asp Ser Leu Pro Asp Lys Tyr Asn Thr Arg Val Gly
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Ala Arg Ala Leu Val Arg Gln Pro His Ile Leu Leu Leu Asp Glu Ala
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Ser Thr Ile Gln Asn Ala Asp Leu Ile Val Val Ile Glu Asn Gly Lys

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Tyr Met Leu Val Gly Thr Leu Ala Ala Ile Ile His Gly Val Ala Leu
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Pro Leu Met Met Leu Ile Phe Gly Asp Met Thr Asp Ser Phe Ala Ser
65 70 75 80

Val Gly Asn Val Ser Lys Asn Ser Thr Asn Met Ser Glu Ala Asp Lys
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Arg Ala Met Phe Ala Lys Leu Glu Glu Glu Met Thr Thr Tyr Ala Tyr
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Tyr Tyr Thr Gly Ile Gly Ala Gly Val Leu Ile Val Ala Tyr Ile Gln
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Val Ser Phe Trp Cys Leu Ala Ala Gly Arg Gln Ile His Lys Ile Arg
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Gln Lys Phe Phe His Ala Ile Met Asn Gln Glu Ile Gly Trp Phe Asp
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Val His Asp Val Gly Glu Leu Asn Thr Arg Leu Thr Asp Asp Val Ser
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Met Ala Thr Phe Phe Gly Gly Phe Ile Ile Gly Phe Thr Arg Gly Trp
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Tyr Asn Asn Asn Leu Glu Glu Ala Lys Arg Leu Gly Ile Lys Lys Ala

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Ser Tyr Ala Leu Ala Phe Trp Tyr Gly Thr Ser Leu Val Ile Ser Lys
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Glu Tyr Ser Ile Gly Gln Val Leu Thr Val Phe Phe Ser Val Leu Ile
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Pro Ser Ile Asp Ser Phe Ser Lys Ser Gly His Lys Pro Asp Asn Ile
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Glu Lys Ala Val Lys Glu Ala Asn Ala Tyr Asp Phe Ile Met Lys Leu
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Gly Gly Gln Lys Gln Arg Ile Ala Ile Ala Arg Ala Leu Val Arg Asn

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Pro Lys Ile Leu Leu Leu Asp Glu Ala Thr Ser Ala Leu Asp Thr Glu
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Thr Thr Ile Val Ile Ala His Arg Leu Ser Thr Val Arg Asn Ala Asp
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Val Ile Ala Gly Phe Asp Gly Gly Val Ile Val Glu Gln Gly Asn His
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Asp Glu Leu Met Arg Glu Lys Gly Ile Tyr Phe Lys Leu Val Met Thr
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Gln Thr Ala Gly Asn Glu Ile Glu Leu Gly Asn Glu Ala Cys Lys Ser
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690 695 700

Pro Tyr Phe Val Val Gly Ile Phe Cys Ala Ile Ile Asn Gly Gly Leu
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Gln Pro Ala Phe Ser Val Ile Phe Ser Lys Val Val Gly Val Phe Thr
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Asn Gly Gly Pro Pro Glu Thr Gln Arg Gln Asn Ser Asn Leu Phe Ser
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Leu Leu Phe Leu Ile Leu Gly Ile Ile Ser Phe Ile Thr Phe Phe Leu
755 760 765

Gln Gly Phe Thr Phe Gly Lys Ala Gly Glu Ile Leu Thr Lys Arg Leu
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Phe Gln Asn Ile Ala Asn Leu Gly Thr Gly Ile Ile Ile Ser Leu Ile
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Tyr Gly Trp Gln Leu Thr Leu Leu Leu Leu Ala Ile Val Pro Ile Ile
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Glu Thr Met Tyr Ala Gln Ser Leu Gln Ile Pro Tyr Arg Asn Ala Met
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Lys Lys Ala His Val Phe Gly Ile Thr Phe Ser Phe Thr Gln Ala Met
930 935 940

Met Tyr Phe Ser Tyr Ala Ala Cys Phe Arg Phe Gly Ala Tyr Leu Val
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Thr Gln Gln Leu Met Thr Phe Glu Asn Val Leu Leu Val Phe Ser Ala
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Ile Val Phe Gly Ala Met Ala Val Gly Gln Val Ser Ser Phe Ala Pro
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Asp Tyr Ala Lys Ala Thr Val Ser Ala Ser His Ile Ile Arg Ile Ile
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Pro Thr Arg Pro Ser Ile Pro Val Leu Gln Gly Leu Ser Leu Glu Val

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Phe Ile Asp Ser Leu Pro Asp Lys Tyr Asn Thr Arg Val Gly Asp Lys
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Ile Gln Asn Ala Asp Leu Ile Val Val Ile Gln Asn Gly Lys Val Lys
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tgcctccgag cgcacgcatc ctgagatcct gagcctttgg ttaagaccga gctctattaa 180

gctgaaaaga taaaaactct ccag atg tct tcc agt aat gtc gaa gtt ttt 231
Met Ser Ser Ser Asn Val Glu Val Phe
1 5

atc cca gtg tca caa gga aac acc aat ggc ttc ccc gcg aca gtt tcc 279
Ile Pro Val Ser Gln Gly Asn Thr Asn Gly Phe Pro Ala Thr Val Ser
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aat gac ctg aag gca ttt act gaa gga gct gtg tta agt ttt cat aac 327
Asn Asp Leu Lys Ala Phe Thr Glu Gly Ala Val Leu Ser Phe His Asn
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atc tgc tat cga gta aaa ctg aag agt ggc ttt cta cct tgt cga aaa 375
Ile Cys Tyr Arg Val Lys Leu Lys Ser Gly Phe Leu Pro Cys Arg Lys
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cca gtt gag aaa gaa ata tta tcg aat atc aat ggg atc atg aaa cct 423
Pro Val Glu Lys Glu Ile Leu Ser Asn Ile Asn Gly Ile Met Lys Pro
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Gly Leu Asn Ala Ile Leu Gly Pro Thr Gly Gly Gly Lys Ser Ser Leu
75 80 85

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Leu Asp Val Leu Ala Ala Arg Lys Asp Pro Ser Gly Leu Ser Gly Asp
90 95 100 105

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Val Leu Ile Asn Gly Ala Pro Arg Pro Ala Asn Phe Lys Cys Asn Ser
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Gly Tyr Val Val Gln Asp Asp Val Val Met Gly Thr Leu Thr Val Arg
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aat cat gaa aaa aac gaa cgg att aac agg gtc att gaa gag tta ggt   711
Asn His Glu Lys Asn Glu Arg Ile Asn Arg Val Ile Glu Glu Leu Gly
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ctg gat aaa gtg gca gac tcc aag gtt gga act cag ttt atc cgt ggt   759
Leu Asp Lys Val Ala Asp Ser Lys Val Gly Thr Gln Phe Ile Arg Gly
170                 175                 180                 185

gtg tct gga gga gaa aga aaa agg act agt ata gga atg gag ctt atc   807
Val Ser Gly Gly Glu Arg Lys Arg Thr Ser Ile Gly Met Glu Leu Ile
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act gat cct tcc atc ttg tcc ttg gat gag cct aca act ggc tta gac   855
Thr Asp Pro Ser Ile Leu Ser Leu Asp Glu Pro Thr Thr Gly Leu Asp
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tca agc aca gca aat gct gtc ctt ttg ctc ctg aaa agg atg tct aag   903
Ser Ser Thr Ala Asn Ala Val Leu Leu Leu Leu Lys Arg Met Ser Lys
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cag gga cga aca atc atc ttc tcc att cat cag cct cga tat tcc atc   951
Gln Gly Arg Thr Ile Ile Phe Ser Ile His Gln Pro Arg Tyr Ser Ile
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ttc aag ttg ttt gat agc ctc acc tta ttg gcc tca gga aga ctt atg   999
Phe Lys Leu Phe Asp Ser Leu Thr Leu Leu Ala Ser Gly Arg Leu Met
250                 255                 260                 265

ttc cac ggg cct gct cag gag gcc ttg gga tac ttt gaa tca gct ggt  1047
Phe His Gly Pro Ala Gln Glu Ala Leu Gly Tyr Phe Glu Ser Ala Gly
                270                 275                 280

tat cac tgt gag gcc tat aat aac cct gca gac ttc ttc ttg gac atc  1095
Tyr His Cys Glu Ala Tyr Asn Asn Pro Ala Asp Phe Phe Leu Asp Ile
            285                 290                 295

att aat gga gat tcc act gct gtg gca tta aac aga gaa gaa gac ttt  1143
Ile Asn Gly Asp Ser Thr Ala Val Ala Leu Asn Arg Glu Glu Asp Phe
        300                 305                 310

aaa gcc aca gag atc ata gag cct tcc aag cag gat aag cca ctc ata  1191
Lys Ala Thr Glu Ile Ile Glu Pro Ser Lys Gln Asp Lys Pro Leu Ile
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aaa gct gaa tta cat caa ctt tcc ggg ggt gag aag aag aag aag atc   1287
Lys Ala Glu Leu His Gln Leu Ser Gly Gly Glu Lys Lys Lys Lys Ile
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aca gtc ttc aag gag atc agc tac acc acc tcc ttc tgt cat caa ctc   1335
Thr Val Phe Lys Glu Ile Ser Tyr Thr Thr Ser Phe Cys His Gln Leu
            365                 370                 375

aga tgg gtt tcc aag cgt tca ttc aaa aac ttg ctg ggt aat ccc cag   1383
Arg Trp Val Ser Lys Arg Ser Phe Lys Asn Leu Leu Gly Asn Pro Gln
        380                 385                 390

gcc tct ata gct cag atc att gtc aca gtc gta ctg gga ctg gtt ata   1431
Ala Ser Ile Ala Gln Ile Ile Val Thr Val Val Leu Gly Leu Val Ile
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ggt gcc att tac ttt ggg cta aaa aat gat tct act gga atc cag aac   1479
Gly Ala Ile Tyr Phe Gly Leu Lys Asn Asp Ser Thr Gly Ile Gln Asn
410                 415                 420                 425

aga gct ggg gtt ctc ttc ttc ctg acg acc aac cag tgt ttc agc agt   1527
Arg Ala Gly Val Leu Phe Phe Leu Thr Thr Asn Gln Cys Phe Ser Ser
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gtt tca gcc gtg gaa ctc ttt gtg gta gag aag aag ctc ttc ata cat   1575
Val Ser Ala Val Glu Leu Phe Val Val Glu Lys Lys Leu Phe Ile His
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gaa tac atc agc gga tac tac aga gtg tca tct tat ttc ctt gga aaa   1623
Glu Tyr Ile Ser Gly Tyr Tyr Arg Val Ser Ser Tyr Phe Leu Gly Lys
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ctg tta tct gat tta tta ccc atg agg atg tta cca agt att ata ttt   1671
Leu Leu Ser Asp Leu Leu Pro Met Arg Met Leu Pro Ser Ile Ile Phe
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acc tgt ata gtg tac ttc atg tta gga ttg aag cca aag gca gat gcc   1719
Thr Cys Ile Val Tyr Phe Met Leu Gly Leu Lys Pro Lys Ala Asp Ala
490                 495                 500                 505

ttc ttc gtt atg atg ttt acc ctt atg atg gtg gct tat tca gcc agt   1767
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Ser Met Ala Leu Ala Ile Ala Ala Gly Gln Ser Val Val Ser Val Ala
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aca ctt ctc atg acc atc tgt ttt gtg ttt atg atg att ttt tca ggt   1863
Thr Leu Leu Met Thr Ile Cys Phe Val Phe Met Met Ile Phe Ser Gly
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ctg ttg gtc aat ctc aca acc att gca tct tgg ctg tca tgg ctt cag   1911
Leu Leu Val Asn Leu Thr Thr Ile Ala Ser Trp Leu Ser Trp Leu Gln
    555                 560                 565

tac ttc agc att cca cga tat gga ttt acg gct ttg cag cat aat gaa   1959
Tyr Phe Ser Ile Pro Arg Tyr Gly Phe Thr Ala Leu Gln His Asn Glu
570                 575                 580                 585

ttt ttg gga caa aac ttc tgc cca gga ctc aat gca aca gga aac aat   2007
Phe Leu Gly Gln Asn Phe Cys Pro Gly Leu Asn Ala Thr Gly Asn Asn
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cct tgt aac tat gca aca tgt act ggc gaa gaa tat ttg gta aag cag   2055
Pro Cys Asn Tyr Ala Thr Cys Thr Gly Glu Glu Tyr Leu Val Lys Gln
            605                 610                 615

ggc atc gat ctc tca ccc tgg ggc ttg tgg aag aat cac gtg gcc ttg   2103
Gly Ile Asp Leu Ser Pro Trp Gly Leu Trp Lys Asn His Val Ala Leu
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gct tgt atg att gtt att ttc ctc aca att gcc tac ctg aaa ttg tta   2151
Ala Cys Met Ile Val Ile Phe Leu Thr Ile Ala Tyr Leu Lys Leu Leu
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Phe Leu Lys Lys Tyr Ser
650                 655

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Lys Ser Gly Phe Leu Pro Cys Arg Lys Pro Val Glu Lys Glu Ile Leu
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Ser Asn Ile Asn Gly Ile Met Lys Pro Gly Leu Asn Ala Ile Leu Gly
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Pro Thr Gly Gly Gly Lys Ser Ser Leu Leu Asp Val Leu Ala Ala Arg
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Lys Asp Pro Ser Gly Leu Ser Gly Asp Val Leu Ile Asn Gly Ala Pro
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Arg Pro Ala Asn Phe Lys Cys Asn Ser Gly Tyr Val Val Gln Asp Asp
115 120 125

Val Val Met Gly Thr Leu Thr Val Arg Glu Asn Leu Gln Phe Ser Ala
130 135 140

Ala Leu Arg Leu Ala Thr Thr Met Thr Asn His Glu Lys Asn Glu Arg
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Ile Asn Arg Val Ile Glu Glu Leu Gly Leu Asp Lys Val Ala Asp Ser
165 170 175

Lys Val Gly Thr Gln Phe Ile Arg Gly Val Ser Gly Gly Glu Arg Lys

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Arg Thr Ser Ile Gly Met Glu Leu Ile Thr Asp Pro Ser Ile Leu Ser
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Leu Asp Glu Pro Thr Thr Gly Leu Asp Ser Ser Thr Ala Asn Ala Val
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Leu Leu Leu Leu Lys Arg Met Ser Lys Gln Gly Arg Thr Ile Ile Phe
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Ser Ile His Gln Pro Arg Tyr Ser Ile Phe Lys Leu Phe Asp Ser Leu
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Thr Leu Leu Ala Ser Gly Arg Leu Met Phe His Gly Pro Ala Gln Glu
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Ala Leu Gly Tyr Phe Glu Ser Ala Gly Tyr His Cys Glu Ala Tyr Asn
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Asn Pro Ala Asp Phe Phe Leu Asp Ile Ile Asn Gly Asp Ser Thr Ala
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Val Ala Leu Asn Arg Glu Glu Asp Phe Lys Ala Thr Glu Ile Ile Glu
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Pro Ser Lys Gln Asp Lys Pro Leu Ile Glu Lys Leu Ala Glu Ile Tyr
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Val Asn Ser Ser Phe Tyr Lys Glu Thr Lys Ala Glu Leu His Gln Leu
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Ser Gly Gly Glu Lys Lys Lys Lys Ile Thr Val Phe Lys Glu Ile Ser
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Tyr Thr Thr Ser Phe Cys His Gln Leu Arg Trp Val Ser Lys Arg Ser
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Phe Lys Asn Leu Leu Gly Asn Pro Gln Ala Ser Ile Ala Gln Ile Ile
385                 390                 395                 400

Val Thr Val Val Leu Gly Leu Val Ile Gly Ala Ile Tyr Phe Gly Leu
                405                 410                 415

Lys Asn Asp Ser Thr Gly Ile Gln Asn Arg Ala Gly Val Leu Phe Phe
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Leu Gly Leu Lys Pro Lys Ala Asp Ala Phe Phe Val Met Met Phe Thr
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Leu Met Met Val Ala Tyr Ser Ala Ser Ser Met Ala Leu Ala Ile Ala
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Ala Gly Gln Ser Val Val Ser Val Ala Thr Leu Leu Met Thr Ile Cys
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Phe Val Phe Met Met Ile Phe Ser Gly Leu Leu Val Asn Leu Thr Thr
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Thr Gly Glu Glu Tyr Leu Val Lys Gln Gly Ile Asp Leu Ser Pro Trp
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<220>

<221> CDS
<222> (1)..(444)

<400> 11
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Phe Gly Leu Gly Ala Glu Ala Tyr Thr Ala Ser Ser Met Ala Leu Ala
1 5 10 15

ata gcc aca ggc caa agt gtg gtg tct gta gca aca cta ctc atg aca 96
Ile Ala Thr Gly Gln Ser Val Val Ser Val Ala Thr Leu Leu Met Thr
20 25 30

atc gct ttt gta ttt atg atg ctc ttt tct ggc ctc ttg gtg aat ctc 144
Ile Ala Phe Val Phe Met Met Leu Phe Ser Gly Leu Leu Val Asn Leu
35 40 45

aga acc att ggg cct tgg ctg tcc tgg ctt cag tac ttt agc att cct 192
Arg Thr Ile Gly Pro Trp Leu Ser Trp Leu Gln Tyr Phe Ser Ile Pro
50 55 60

cga tat ggc ttc aca gct ttg cag tat aat gaa ttc ttg gga caa gag 240
Arg Tyr Gly Phe Thr Ala Leu Gln Tyr Asn Glu Phe Leu Gly Gln Glu
65 70 75 80

ttt tgt cca gga ttc aat gta acg gac aac agc act tgt gtt aac agc 288
Phe Cys Pro Gly Phe Asn Val Thr Asp Asn Ser Thr Cys Val Asn Ser
85 90 95

tat gca ata tgt act ggt aac gag tac ttg ata aat cag ggc atc gaa 336
Tyr Ala Ile Cys Thr Gly Asn Glu Tyr Leu Ile Asn Gln Gly Ile Glu
100 105 110

ctg tca cct tgg gga ctg tgg aag aat cat gtg gcc ctg gct tgt atg 384
Leu Ser Pro Trp Gly Leu Trp Lys Asn His Val Ala Leu Ala Cys Met
115 120 125

att att atc ttc ctc aca att gcc tac ctg aaa ttg ttg ttt ctt aaa 432
Ile Ile Ile Phe Leu Thr Ile Ala Tyr Leu Lys Leu Leu Phe Leu Lys
130 135 140

aag tat tct taa tttccccttt aacggactat taattgtact ccaattaaat 484
Lys Tyr Ser
145

atgggcactt tgattacc 502

<210> 12

<211> 147
<212> PRT
<213> Mus musculus

<400> 12
Phe Gly Leu Gly Ala Glu Ala Tyr Thr Ala Ser Ser Met Ala Leu Ala
1 5 10 15

Ile Ala Thr Gly Gln Ser Val Val Ser Val Ala Thr Leu Leu Met Thr
20 25 30

Ile Ala Phe Val Phe Met Met Leu Phe Ser Gly Leu Leu Val Asn Leu
35 40 45

Arg Thr Ile Gly Pro Trp Leu Ser Trp Leu Gln Tyr Phe Ser Ile Pro
50 55 60

Arg Tyr Gly Phe Thr Ala Leu Gln Tyr Asn Glu Phe Leu Gly Gln Glu
65 70 75 80

Phe Cys Pro Gly Phe Asn Val Thr Asp Asn Ser Thr Cys Val Asn Ser
85 90 95

Tyr Ala Ile Cys Thr Gly Asn Glu Tyr Leu Ile Asn Gln Gly Ile Glu
100 105 110

Leu Ser Pro Trp Gly Leu Trp Lys Asn His Val Ala Leu Ala Cys Met
115 120 125

Ile Ile Ile Phe Leu Thr Ile Ala Tyr Leu Lys Leu Leu Phe Leu Lys
130 135 140

Lys Tyr Ser
145

<210> 13
<211> 2025
<212> DNA
<213> Mus musculus

<220>
<221> CDS
<222> (20)..(1993)

<400> 13
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Met Ser Ser Ser Asn Asp His Val Leu Val Pro

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                        1               5                  10

atg tcg cag aga aac aac aac ggc ctt cct agg atg aac tcc aga gcc   100
Met Ser Gln Arg Asn Asn Asn Gly Leu Pro Arg Met Asn Ser Arg Ala
                15                  20                  25

gtt agg acg ctc gca gaa gga gat gtg ttg agt ttt cat cac atc acc   148
Val Arg Thr Leu Ala Glu Gly Asp Val Leu Ser Phe His His Ile Thr
            30                  35                  40

tat cga gtg aaa gta aag agt ggg ttt cta gtc cgg aaa aca gtt gag   196
Tyr Arg Val Lys Val Lys Ser Gly Phe Leu Val Arg Lys Thr Val Glu
        45                  50                  55

aaa gaa ata cta tca gat atc aat ggg atc atg aaa cct ggc ctt aat   244
Lys Glu Ile Leu Ser Asp Ile Asn Gly Ile Met Lys Pro Gly Leu Asn
    60                  65                  70                  75

gct att ctg gga ccc aca ggc gga ggc aag tct tcg ttg cta gat gtc   292
Ala Ile Leu Gly Pro Thr Gly Gly Gly Lys Ser Ser Leu Leu Asp Val
                80                  85                  90

tta gca gca agg aaa gat cca aag gga tta tct gga gat gtt ttg ata   340
Leu Ala Ala Arg Lys Asp Pro Lys Gly Leu Ser Gly Asp Val Leu Ile
            95                  100                 105

aat gga gca cct caa cct gcc cat ttc aaa tgc tgt tca ggt tat gtg   388
Asn Gly Ala Pro Gln Pro Ala His Phe Lys Cys Cys Ser Gly Tyr Val
        110                 115                 120

gtt caa gat gac gtt gtg atg ggc acc ctg aca gtg aga gaa aac tta   436
Val Gln Asp Asp Val Val Met Gly Thr Leu Thr Val Arg Glu Asn Leu
    125                 130                 135

cag ttc tca gca gct ctt cga ctt cca aca act atg aag aat cat gaa   484
Gln Phe Ser Ala Ala Leu Arg Leu Pro Thr Thr Met Lys Asn His Glu
140                 145                 150                 155

aaa aat gaa cgg att aac aca atc att aaa gag tta ggt ctg gaa aaa   532
Lys Asn Glu Arg Ile Asn Thr Ile Ile Lys Glu Leu Gly Leu Glu Lys
                160                 165                 170

gta gca gat tct aag gtc gga act cag ttt atc cgt ggc atc tct gga   580
Val Ala Asp Ser Lys Val Gly Thr Gln Phe Ile Arg Gly Ile Ser Gly
            175                 180                 185

gga gaa aga aaa agg aca agc ata ggg atg gag ctg atc act gac cct   628
Gly Glu Arg Lys Arg Thr Ser Ile Gly Met Glu Leu Ile Thr Asp Pro
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        190                 195                 200

tcc atc ctc ttc ctg gat gag ccc acg act ggt ttg gac tca agc aca   676
Ser Ile Leu Phe Leu Asp Glu Pro Thr Thr Gly Leu Asp Ser Ser Thr
    205                 210                 215

gcg aat gct gtc ctt ttg ctc ctg aaa agg atg tct aaa cag ggt cga   724
Ala Asn Ala Val Leu Leu Leu Leu Lys Arg Met Ser Lys Gln Gly Arg
220                 225                 230                 235

aca atc atc ttc tcc att cat cag cct cgg tat tcc atc ttt aag ttg   772
Thr Ile Ile Phe Ser Ile His Gln Pro Arg Tyr Ser Ile Phe Lys Leu
                240                 245                 250

ttt gac agc ctc acc tta ctg gct tcc ggg aaa ctc gtg ttc cat ggg   820
Phe Asp Ser Leu Thr Leu Leu Ala Ser Gly Lys Leu Val Phe His Gly
            255                 260                 265

cca gca cag aag gcc ttg gag tac ttt gca tca gca ggt tac cac tgt   868
Pro Ala Gln Lys Ala Leu Glu Tyr Phe Ala Ser Ala Gly Tyr His Cys
        270                 275                 280

gag ccc tac aac aac cct gcg gat ttt ttc ctt gat gtc atc aat gga   916
Glu Pro Tyr Asn Asn Pro Ala Asp Phe Phe Leu Asp Val Ile Asn Gly
    285                 290                 295

gat tct tct gct gtg atg tta aat aga gag gaa caa gac aat gaa gca   964
Asp Ser Ser Ala Val Met Leu Asn Arg Glu Glu Gln Asp Asn Glu Ala
300                 305                 310                 315

aac aag act gaa gag cct tcc aag gga gag aag cca gta ata gaa aat   1012
Asn Lys Thr Glu Glu Pro Ser Lys Gly Glu Lys Pro Val Ile Glu Asn
                320                 325                 330

tta tct gag ttt tat atc aac tct gcc atc tat gga gaa aca aaa gct   1060
Leu Ser Glu Phe Tyr Ile Asn Ser Ala Ile Tyr Gly Glu Thr Lys Ala
            335                 340                 345

gaa tta gat caa ctt cca gga gct cag gaa aag aaa gga aca tcg gcc   1108
Glu Leu Asp Gln Leu Pro Gly Ala Gln Glu Lys Lys Gly Thr Ser Ala
        350                 355                 360

ttc aaa gag cca gtc tat gtt acc tct ttc tgt cac cag ctc cga tgg   1156
Phe Lys Glu Pro Val Tyr Val Thr Ser Phe Cys His Gln Leu Arg Trp
    365                 370                 375

att gcc agg cgc tca ttt aaa aac ttg ctc ggg aac cct caa gct tct   1204
Ile Ala Arg Arg Ser Phe Lys Asn Leu Leu Gly Asn Pro Gln Ala Ser
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380                 385                 390                 395

gtt gct cag tta att gtt aca gtc ata ctg ggg ctt att att ggt gcc  1252
Val Ala Gln Leu Ile Val Thr Val Ile Leu Gly Leu Ile Ile Gly Ala
                400                 405                 410

att tac ttt gat ctg aaa tat gat gcc gct gga atg caa aat aga gct  1300
Ile Tyr Phe Asp Leu Lys Tyr Asp Ala Ala Gly Met Gln Asn Arg Ala
            415                 420                 425

gga gtt ttg ttt ttc ctg act acc aac cag tgt ttt tcc agt gtg tca  1348
Gly Val Leu Phe Phe Leu Thr Thr Asn Gln Cys Phe Ser Ser Val Ser
        430                 435                 440

gct gtg gag ctg ttc gta gtg gag aag aaa ctc ttc ata cat gag tac  1396
Ala Val Glu Leu Phe Val Val Glu Lys Lys Leu Phe Ile His Glu Tyr
    445                 450                 455

atc agt gga tat tac aga gtg tct tct tac ttc ttt gga aag gtg atg  1444
Ile Ser Gly Tyr Tyr Arg Val Ser Ser Tyr Phe Phe Gly Lys Val Met
460                 465                 470                 475

tct gat tta ctc ccc atg agg ttc ttg cca agt gtt ata ttc act tgt  1492
Ser Asp Leu Leu Pro Met Arg Phe Leu Pro Ser Val Ile Phe Thr Cys
                480                 485                 490

ata tta tac ttc atg tta gga ctg aag aag acg gtg gat gct ttt ttc  1540
Ile Leu Tyr Phe Met Leu Gly Leu Lys Lys Thr Val Asp Ala Phe Phe
            495                 500                 505

atc atg atg ttt acc ctt ata atg gtg gct tat acg gcc agt tcc atg  1588
Ile Met Met Phe Thr Leu Ile Met Val Ala Tyr Thr Ala Ser Ser Met
        510                 515                 520

gca ctg gcc ata gcc aca ggc caa agt gtg gtg tct gta gca aca ctt  1636
Ala Leu Ala Ile Ala Thr Gly Gln Ser Val Val Ser Val Ala Thr Leu
    525                 530                 535

ctc atg aca atc gct ttt gta ttt atg atg ctc ttt tct ggc ctc ttg  1684
Leu Met Thr Ile Ala Phe Val Phe Met Met Leu Phe Ser Gly Leu Leu
540                 545                 550                 555

gtg aat ctc aga acc att ggg cct tgg ctg tcc tgg ctt cag tac ttt  1732
Val Asn Leu Arg Thr Ile Gly Pro Trp Leu Ser Trp Leu Gln Tyr Phe
                560                 565                 570

agc att cct cga tat ggc ttc aca gct ttg cag tat aat gaa ttc ttg  1780
Ser Ile Pro Arg Tyr Gly Phe Thr Ala Leu Gln Tyr Asn Glu Phe Leu
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            575                 580                 585

gga caa gag ttt tgt cca gga ttc aat gta acg gac aac agc act tgt   1828
Gly Gln Glu Phe Cys Pro Gly Phe Asn Val Thr Asp Asn Ser Thr Cys
        590                 595                 600

gtt aac agc tat gca ata tgt act ggt aac gag tac ttg ata aat cag   1876
Val Asn Ser Tyr Ala Ile Cys Thr Gly Asn Glu Tyr Leu Ile Asn Gln
    605                 610                 615

ggc atc gaa ctg tca cct tgg gga ctg tgg aag aat cat gtg gcc ctg   1924
Gly Ile Glu Leu Ser Pro Trp Gly Leu Trp Lys Asn His Val Ala Leu
620                 625                 630                 635

gct tgt atg att att atc ttc ctc aca att gcc tac ctg aaa ttg ttg   1972
Ala Cys Met Ile Ile Ile Phe Leu Thr Ile Ala Tyr Leu Lys Leu Leu
                640                 645                 650

ttt ctt aaa aag tat tct taa tttccccttt aacggactat taattgtact cc   2025
Phe Leu Lys Lys Tyr Ser
            655
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<210> 14
<211> 657
<212> PRT
<213> Mus musculus

<400> 14

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Asn Asn Gly Leu Pro Arg Met Asn Ser Arg Ala Val Arg Thr Leu Ala
             20                  25                  30

Glu Gly Asp Val Leu Ser Phe His His Ile Thr Tyr Arg Val Lys Val
         35                  40                  45

Lys Ser Gly Phe Leu Val Arg Lys Thr Val Glu Lys Glu Ile Leu Ser
     50                  55                  60

Asp Ile Asn Gly Ile Met Lys Pro Gly Leu Asn Ala Ile Leu Gly Pro
 65                  70                  75                  80

Thr Gly Gly Gly Lys Ser Ser Leu Leu Asp Val Leu Ala Ala Arg Lys
                 85                  90                  95

Asp Pro Lys Gly Leu Ser Gly Asp Val Leu Ile Asn Gly Ala Pro Gln
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100 105 110

Pro Ala His Phe Lys Cys Cys Ser Gly Tyr Val Val Gln Asp Asp Val
115 120 125

Val Met Gly Thr Leu Thr Val Arg Glu Asn Leu Gln Phe Ser Ala Ala
130 135 140

Leu Arg Leu Pro Thr Thr Met Lys Asn His Glu Lys Asn Glu Arg Ile
145 150 155 160

Asn Thr Ile Ile Lys Glu Leu Gly Leu Glu Lys Val Ala Asp Ser Lys
165 170 175

Val Gly Thr Gln Phe Ile Arg Gly Ile Ser Gly Gly Glu Arg Lys Arg
180 185 190

Thr Ser Ile Gly Met Glu Leu Ile Thr Asp Pro Ser Ile Leu Phe Leu
195 200 205

Asp Glu Pro Thr Thr Gly Leu Asp Ser Ser Thr Ala Asn Ala Val Leu
210 215 220

Leu Leu Leu Lys Arg Met Ser Lys Gln Gly Arg Thr Ile Ile Phe Ser
225 230 235 240

Ile His Gln Pro Arg Tyr Ser Ile Phe Lys Leu Phe Asp Ser Leu Thr
245 250 255

Leu Leu Ala Ser Gly Lys Leu Val Phe His Gly Pro Ala Gln Lys Ala
260 265 270

Leu Glu Tyr Phe Ala Ser Ala Gly Tyr His Cys Glu Pro Tyr Asn Asn
275 280 285

Pro Ala Asp Phe Phe Leu Asp Val Ile Asn Gly Asp Ser Ser Ala Val
290 295 300

Met Leu Asn Arg Glu Glu Gln Asp Asn Glu Ala Asn Lys Thr Glu Glu
305 310 315 320

Pro Ser Lys Gly Glu Lys Pro Val Ile Glu Asn Leu Ser Glu Phe Tyr
325 330 335

Ile Asn Ser Ala Ile Tyr Gly Glu Thr Lys Ala Glu Leu Asp Gln Leu
340 345 350

Pro Gly Ala Gln Glu Lys Lys Gly Thr Ser Ala Phe Lys Glu Pro Val

355 360 365

Tyr Val Thr Ser Phe Cys His Gln Leu Arg Trp Ile Ala Arg Arg Ser
370 375 380

Phe Lys Asn Leu Leu Gly Asn Pro Gln Ala Ser Val Ala Gln Leu Ile
385 390 395 400

Val Thr Val Ile Leu Gly Leu Ile Ile Gly Ala Ile Tyr Phe Asp Leu
405 410 415

Lys Tyr Asp Ala Ala Gly Met Gln Asn Arg Ala Gly Val Leu Phe Phe
420 425 430

Leu Thr Thr Asn Gln Cys Phe Ser Ser Val Ser Ala Val Glu Leu Phe
435 440 445

Val Val Glu Lys Lys Leu Phe Ile His Glu Tyr Ile Ser Gly Tyr Tyr
450 455 460

Arg Val Ser Ser Tyr Phe Phe Gly Lys Val Met Ser Asp Leu Leu Pro
465 470 475 480

Met Arg Phe Leu Pro Ser Val Ile Phe Thr Cys Ile Leu Tyr Phe Met
485 490 495

Leu Gly Leu Lys Lys Thr Val Asp Ala Phe Phe Ile Met Met Phe Thr
500 505 510

Leu Ile Met Val Ala Tyr Thr Ala Ser Ser Met Ala Leu Ala Ile Ala
515 520 525

Thr Gly Gln Ser Val Val Ser Val Ala Thr Leu Leu Met Thr Ile Ala
530 535 540

Phe Val Phe Met Met Leu Phe Ser Gly Leu Leu Val Asn Leu Arg Thr
545 550 555 560

Ile Gly Pro Trp Leu Ser Trp Leu Gln Tyr Phe Ser Ile Pro Arg Tyr
565 570 575

Gly Phe Thr Ala Leu Gln Tyr Asn Glu Phe Leu Gly Gln Glu Phe Cys
580 585 590

Pro Gly Phe Asn Val Thr Asp Asn Ser Thr Cys Val Asn Ser Tyr Ala
595 600 605

Ile Cys Thr Gly Asn Glu Tyr Leu Ile Asn Gln Gly Ile Glu Leu Ser

610 615 620

Pro Trp Gly Leu Trp Lys Asn His Val Ala Leu Ala Cys Met Ile Ile
625 630 635 640

Ile Phe Leu Thr Ile Ala Tyr Leu Lys Leu Leu Phe Leu Lys Lys Tyr
645 650 655

Ser

<210> 15
<211> 20
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer.

<400> 15
ccacgtcagc cttggacaca 20

<210> 16
<211> 20
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer.

<400> 16
gccgcttggt gaggatctct 20